Handheld Digital Infrared Thermography Predicts Wound Healing Complications in Lower Extremity Amputations

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Purpose: Lower extremity amputations (LEAs) have a high risk of wound healing complications. Patients undergoing LEA may have inadequate perfusion for healing. Forward Looking Infrared (FLIR) thermography is a handheld digital tool that measures extremity perfusion. We hypothesized that FLIR could be used as a predictive tool for wound healing after LEA.

Methods: 52 patients who underwent LEA (transmetatarsal through hip disarticulation) at 2 Level I trauma centers were enrolled. FLIR images were taken on postoperative day 2 (POD2). Temperature measurements were recorded from multiple points along the incision. Absolute and relative temperatures were compared based on the observed wound healing outcome. Patients were followed for a minimum of 90 days unless they returned to the operating room (RTOR) to treat a wound complication. Primary and secondary outcomes of interest were RTOR for wound healing failure and delayed wound healing requiring local wound care, respectively.

Results: 22 patients healed uneventfully after index procedure, 14 patients RTOR for wound complication, 7 patients were considered to have delayed healing and received outpatient wound care that prolonged time to prosthesis, and 9 were lost to follow-up. A mean temperature of 88.7°F was associated with healing, whereas a mean temperature of 82.9°F was associated with wound complication (88.7 ± 4.2 vs 82.9 ± 5.3°F, $P<0.005$). Incisions that healed were on average 4.5°F colder than the warmest recorded temperature on the residual limb whereas those that did not heal were on average 8.3°F colder (4.5 ± 2.1 vs 8.3 ± 3.6 °F, $P<0.005$).

Conclusion: FLIR images taken on POD2 were able to identify a significant difference in the thermographic profiles of wounds that healed and those that did not. This represents potentially actionable information, warranting continued investigation, that may eventually guide interventions to prevent wound healing failures.